

OCTAVE NOTEBOOK

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DEMONSTRATION TEXT

```
## [Lab 1](#table-of-contents)
### [General Commands](#lab-1table-of-contents)
#### Commands
```matlab
x = 3
y = x + 1
clc # does nothing in script?
clear x
y
6*10/13+18/(5*7)+5*9^2
6*(35^(1/4))+14^0.35
6*(35^(1/4));
```

```
x = [-1:0.5...
:0.51]
quit
```

#### Output
```matlab
x = 3
y = 4
y = 4
ans = 410.13
ans = 17.112
x =

-1.0000 -0.5000 0 0.5000
```
```

PREPRINTED TABS

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SYLLABUS

This browser does not support PDFs. Please download the PDF to view it:
tweoss.github.io/octave/assets/Engineering_60_Notebook_Syllabus.pdf.

LAB 1

General Commands

Commands

```
x = 3
y = x + 1
clc # does nothing in script?
clear x
y
6*10/13+18/(5*7)+5*9^2
6*(35^(1/4))+14^0.35
6*(35^(1/4));
x = [-1:0.5...
:0.51]
quit
```

Output

```
x = 3
y = 4
y = 4
ans = 410.13
ans = 17.112
x =

-1.0000 -0.5000      0  0.5000
```

LAB 2

Variables

Commands

```
r = 8;
h = 15;
V = pi * r ^ 2 * h;
V = V + 0.2 * V;
r = sqrt(V/(pi*h))
```

Output

```
r = 8.7636
```

Complex Numbers

Commands


```

x = -5 + 9i;
y = 6 - 2i;
whos
x + y
x*y
x/y

```

Output

Variables visible from the current scope:

variables in scope: top scope

| Attr | Name | Size | Bytes | Class |
|------|-------|-------|-------|--------|
| ==== | ===== | ===== | ===== | ===== |
| c | x | 1x1 | 16 | double |
| c | y | 1x1 | 16 | double |

Total is 2 elements using 32 bytes

```

ans = 1 + 7i
ans = -12 + 64i
ans = -1.2000 + 1.1000i

```

Arrays

Commands

```

u = [0: 0.1 :10];
w = 5 * sin(u);
u(7)
w(7)
m = length(w)
v = cos(0): 0.02 :log10(100);
length(v)
v(25)

```

Output

```

ans = 0.6000
ans = 2.8232
m = 101
ans = 51
ans = 1.4800

```

Polynomial Roots

Commands

```

a = [1,-7,40,-34];
roots(a)

```

Output

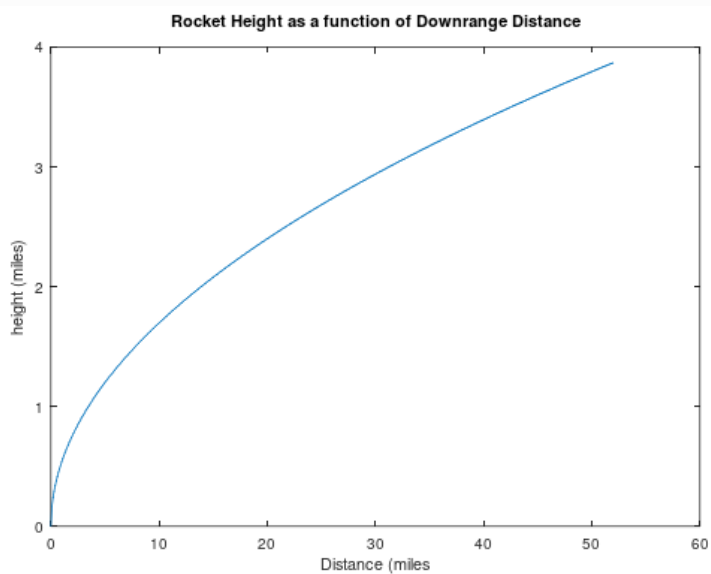
```
ans =  
  
    3.0000 + 5.0000i  
    3.0000 - 5.0000i  
    1.0000 +      0i
```

Plotting

Commands

```
x = [0:0.1:52];  
y = 0.4*sqrt(1.8*x);  
plot(x,y),xlabel('Distance (miles)'),ylabel('height (miles)'),...  
title('Rocket Height as a function of Downrange Distance')  
pause
```

Output



Examples

Square Root

Commands

```
x = [1:10];  
y = sqrt(x)
```

Output

```
y =
```

Columns 1 through 8:

1.0000 1.4142 1.7321 2.0000 2.2361 2.4495 2.6458 2.8284

Columns 9 and 10:

3.0000 3.1623

Population Table

Commands

```
yr = [1984 1986 1988 1990 1992 1994 1996];  
pop = [127 130 136 145 158 178 211];  
tableYP(:,1) = yr';  
tableYP(:,2) = pop';  
disp(''  
disp('    YEAR    POPULATION')  
disp('          (MILLIONS)')  
disp(''  
disp(tableYP)  
disp('')
```

Output

| YEAR | POPULATION
(MILLIONS) |
|------|--------------------------|
| 1984 | 127 |
| 1986 | 130 |
| 1988 | 136 |
| 1990 | 145 |
| 1992 | 158 |
| 1994 | 178 |
| 1996 | 211 |

Average per Game

Commands

```
number1 = input('Enter the points scored in the first game: ');  
if number1 < 0  
    disp('Warning! Input Invalid. Using absolute value.')  
    number1 *= -1;  
end  
number2 = input('Enter the points scored in the second game: ');  
if number2 < 0  
    disp('Warning! Input Invalid. Using absolute value.')  
    number2 *= -1;  
end  
number3 = input('Enter the points scored in the third game: ');  
if number3 < 0  
    disp('Warning! Input Invalid. Using absolute value.')
```

```
number3 *= -1;
end

disp('The average of points scored is ')
disp((number1 + number2 + number3)/3)
```

Output

```
Enter the points scored in the first game: -1
Warning! Input Invalid. Using absolute value.
Enter the points scored in the second game: 2
Enter the points scored in the third game: 0
The average of points scored is
1
```

Projectile Motion

Commands

```
speed = input('Speed: ');
gravity = -9.81;
startHeight = input('Starting Height: ');
angle = input('Starting Angle in Radians: ');
disp('');
angle
horizontalVelocity = speed * cos(angle)
verticalVelocity = speed * sin(angle)
timeInFlight = verticalVelocity/(abs(gravity/2))
horizontalVelocity = timeInFlight * horizontalVelocity
disp('');
```

Output

```
Speed: 50
Starting Height: 0
Starting Angle in Radians: pi/4

angle = 0.7854
horizontalVelocity = 35.355
verticalVelocity = 35.355
timeInFlight = 7.2080
horizontalVelocity = 254.84
```

LAB 3

Question 1

Enter your House Information here.

Enter your House Information here.

| | | | |
|----------|-----------------|------|--------|
| Style | Condo | BD | 2 |
| County | Santa Clara, CA | TB | 2 |
| Sq. Feet | 950 | Acrq | 0.0219 |

Question 2**15-Year Mortgage Loan Details**

| | |
|-----------------------|------------|
| Select a Bank Option: | Bank 1 |
| Closing Costs Fees: | \$1,400.00 |
| Closing Costs Points: | 1.0 |
| Loan Interest Rate: | 3.890% |

30-Year Mortgage Loan Details

| | |
|-----------------------|------------|
| Select a Bank Option: | Bank 1 |
| Closing Costs Fees: | \$1,700.00 |
| Closing Costs Points: | 1.3 |
| Loan Interest Rate: | 4.59% |

Question 3

| | |
|----------------------------|---------------------|
| House Listing Price | \$849,000.00 |
| Down Payment | \$170,000.00 |
| Closing Costs | \$8,190.00 |
| Total Loan Amount | \$687,190.00 |
| APR | 3.89% |
| Loan Term (months) | 180 |
| Monthly Payment | \$5,045.26 |
| Total Payments | \$908,147.57 |
| Total Interest | \$220,957.57 |

Question 4

| | |
|----------------------------|---------------------|
| House Listing Price | \$849,000.00 |
| Down Payment | \$170,000.00 |
| Closing Costs | \$10,187.50 |
| Total Loan Amount | \$689,187.50 |

| | |
|----------------------------|---------------------|
| House Listing Price | \$849,000.00 |
| APR | 4.59% |
| Loan Term (months) | 360 |
| Monthly Payment | \$3,528.96 |
| Total Payments | \$1,270,426.79 |
| Total Interest | \$581,239.29 |

Question 5

| 15-year vs. 30-year Mortgage Comparison | |
|--|------------------|
| Which loan has the higher monthly payment? | 15-year Mortgage |
| How much higher per month is the payment? | \$1,516.30 |
| Which loan has more total interest paid? | 30-year Mortgage |
| How much more total interest is paid? | \$360,281.71 |

| Equity Comparison | |
|--|--------------|
| Suppose you sell your home at year 10 for \$1018800. After you repay the remaining balance of your home, any money you have left over is called equity. The following questions help you compare the equity in your home after 10 years. | |
| 15-year loan ending balance at year 10? | \$274,692.95 |
| 30-year loan ending balance at year 10? | \$553,547.39 |
| 15-year loan equity at year 10? | \$744,107.05 |
| 30-year loan equity at year 10? | \$465,252.61 |

Question 6

While the 15-year mortgage seems objectively better as I would have to pay less in the long term, if I were to purchase the house right now, I would be unable to pay the higher monthly payments. Instead of purchasing a house immediately, I could try to save money now and later take out a 15-year loan.

LAB 4

Exercises Pg 21

Commands

```
2^5/(2^5-1)
(1-1/2^5)^1
3*(sqrt(5)-1)/(sqrt(5)+1)^2-1
```

```

r = pi^(1/3)-1
pi*r^2

disp('')

exp(3)
log(exp(3))
log10(exp(3))
log10(10^5)
exp(pi*sqrt(163))
fsolve(@(x) [3^x-17],0)
log(17)/log(3)

disp('')

sin(pi/6)
cos(pi)
tan(pi/2)
sin(pi/6)^2 + cos(pi/6)^2
x = 32*pi;
y = cosh(x)^2-sinh(x)^2

disp('')

(1+3i)/(1-3i)
e^(i*pi/4)
cos(pi/4)+i*sin(pi/4)
exp(pi/2*i)
exp(pi/2i)
disp('pi/2i => pi/(2*i) != pi/2*i')

```

$$\frac{1+3i}{1-3i} = \frac{(1+3i)(1+3i)}{(1-3i)(1+3i)} = \frac{1+6i-9}{1-(-9)} = \frac{-8+6i}{10} = -0.8 + .6i$$

Output

```

ans = 1.0323
ans = 0.9688
ans = -0.6459
r = 0.4646
ans = 0.6781

ans = 20.086
ans = 3
ans = 1.3029
ans = 5
ans = 2.6254e+17
ans = 2.5789
ans = 2.5789

ans = 0.5000
ans = -1
ans = 1.6331e+16
ans = 1
y = 0

ans = -0.8000 + 0.6000i
ans = 0.7071 + 0.7071i

```

```
ans = 0.7071 + 0.7071i
ans = 6.1232e-17 + 1.0000e+00i
ans = 6.1232e-17 - 1.0000e+00i
pi/2i => pi/(2*i) != pi/2*i
```

Exercises Pg 25

Commands

```
y = @(x) [0.5*x-2];
y(0), y(1.5), y(3), y(4), y(5), y(7), y(9), y(10)

disp('');

t = [1:10];
x = t.*sin(t)
y = (t-1)./(t+1)
z = sin(t.^2)./t.^2

disp('')

theta = [0; pi/4; pi/2; 3*pi/4; pi; 5*pi/4];
r = 2;
x = r*cos(theta)
y = r*sin(theta)
sqrt(x.^2 + y.^2)

disp('')

n = [0:10];
r = 0.5;
sum(r.^n)
1/(1-0.5)
n = [0:50];
sum(r.^n)
n = [0:100];
sum(r.^n)

disp('')

# no page 45 provided
v = 0:0.2:12;
M = [sin(v); cos(v)];
size(v), size(M)
M(1, 1:10)
M(2, 1:10)
```

Output

```
ans = -2
ans = -1.2500
ans = -0.5000
ans = 0
ans = 0.5000
ans = 1.5000
ans = 2.5000
```


ans = 3

x =

Columns 1 through 8:

0.8415 1.8186 0.4234 -3.0272 -4.7946 -1.6765 4.5989 7.9149

Columns 9 and 10:

3.7091 -5.4402

y =

Columns 1 through 8:

0 0.3333 0.5000 0.6000 0.6667 0.7143 0.7500 0.7778

Columns 9 and 10:

0.8000 0.8182

z =

Columns 1 through 6:

8.4147e-01 -1.8920e-01 4.5791e-02 -1.7994e-02 -5.2941e-03 -2.7549e-02

Columns 7 through 10:

-1.9464e-02 1.4375e-02 -7.7764e-03 -5.0637e-03

x =

2.0000e+00
1.4142e+00
1.2246e-16
-1.4142e+00
-2.0000e+00
-1.4142e+00

y =

0
1.4142
2.0000
1.4142
0.0000
-1.4142

ans =

2
2
2
2
2
2

```

ans = 1.9990
ans = 2
ans = 2.0000
ans = 2

ans =

    1    61

ans =

    2    61

ans =

Columns 1 through 8:

    0    0.1987    0.3894    0.5646    0.7174    0.8415    0.9320    0.9854

Columns 9 and 10:

    0.9996    0.9738

ans =

Columns 1 through 7:

    1.000000    0.980067    0.921061    0.825336    0.696707    0.540302    0.362358

Columns 8 through 10:

    0.169967   -0.029200   -0.227202

```

LAB 5

Pg 28 Plot Example

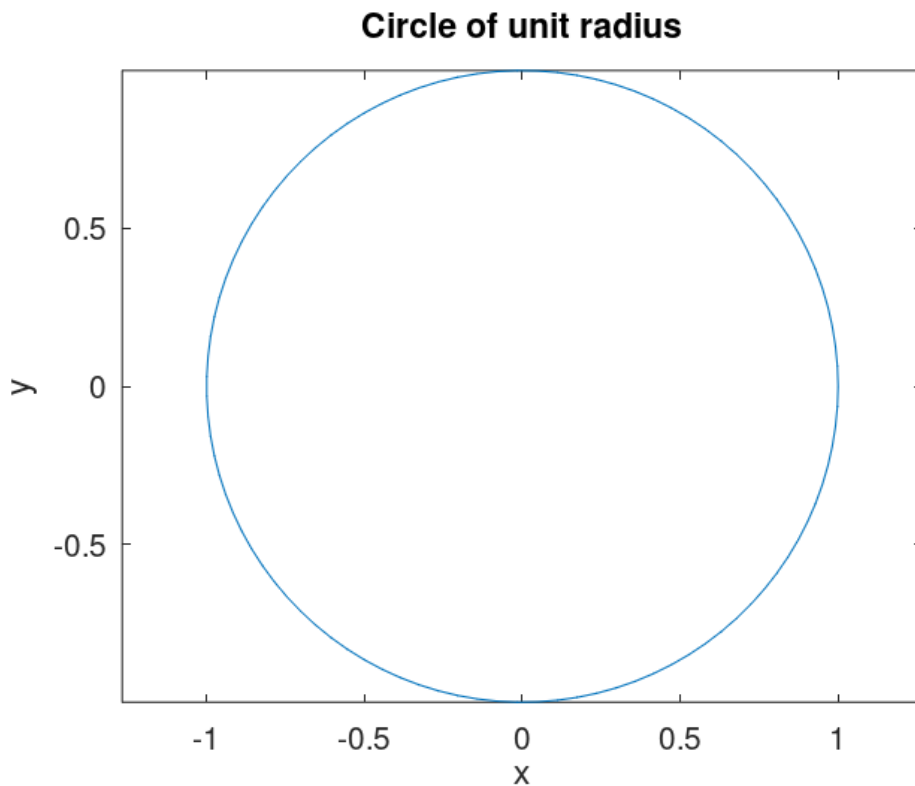
Commands

```

theta = linspace(0,2*pi,100);
x = cos(theta);
y = sin(theta);
plot(x,y)
axis('equal');
xlabel('x')
ylabel('y')
title('Circle of unit radius')
print # Did not make any action
pause; # So the program does not exit immediately.

```

Output



Pg 32 Explanation

Commands

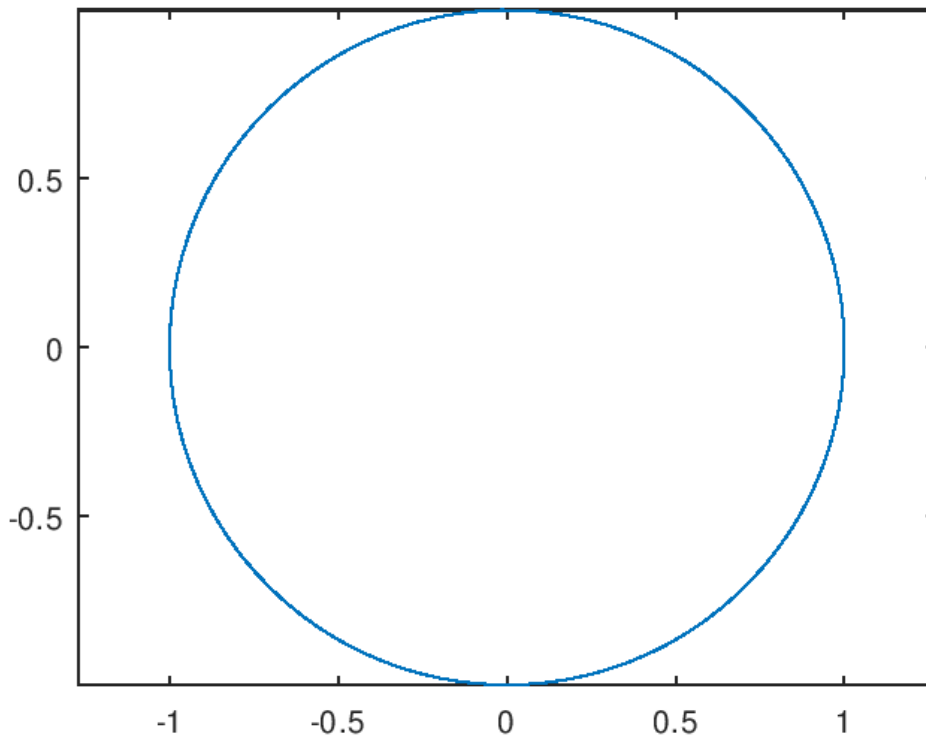
```
% CIRCLE - A script file to draw a unit circle
% File written by Rudra Pratap. Last modified 6/28/98
% -----
theta = linspace(0,2*pi,100); % create vector theta
x = cos(theta);               % generate x-coordinates
y = sin(theta);               % generate y-coordinates
plot(x,y);
axis('equal');
title('Circle of unit radius')
```

Output

```
octave:1> help circle
'circle' is a script from the file /Users/francischua/gitprojects/octave/circle.m

CIRCLE - A script file to draw a unit circle
File written by Rudra Pratap. Last modified 6/28/98
-----
```

Circle of unit radius



Pg 29 Exercise 2.3 Lesson 3

Commands

```
x = linspace(0,2*pi,100);
y = sin(x);
plot(x,y); axis('equal');
title('Plot created by Francis'); xlabel('x'); ylabel('y');
pause
plot(x,y,'o'); axis('equal');
pause
plot(x,y,x,y,'o'); axis('equal');
pause;
```

```
theta = linspace(0,4*pi,100);
y = exp(-0.4*theta).*sin(theta);
axis([-1, 4*pi, -0.5, 10]);
plot(theta,y);
pause;
```

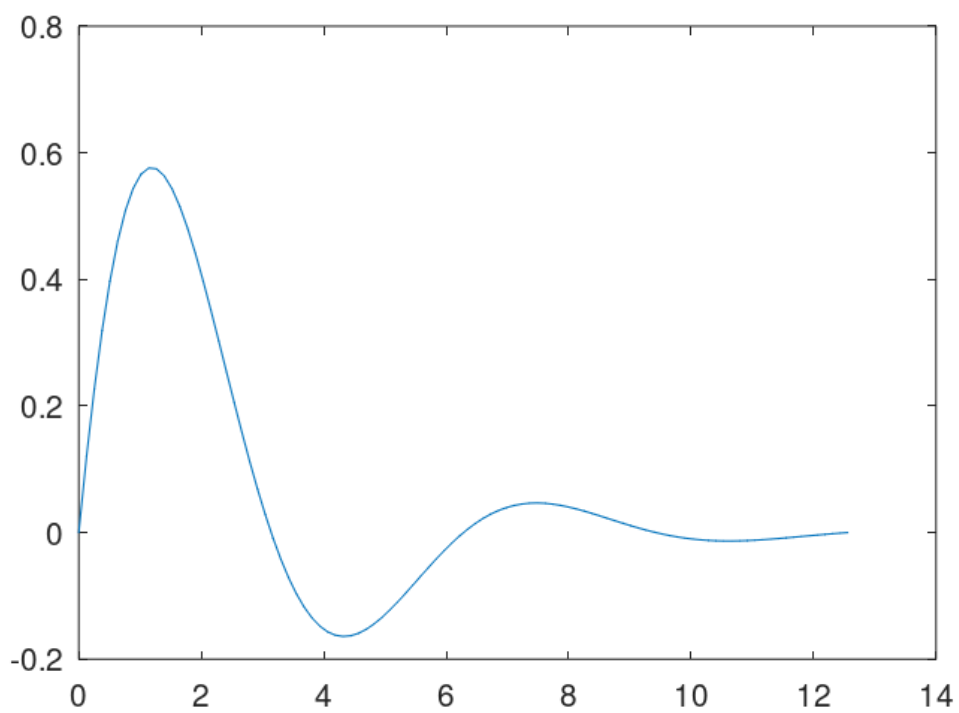
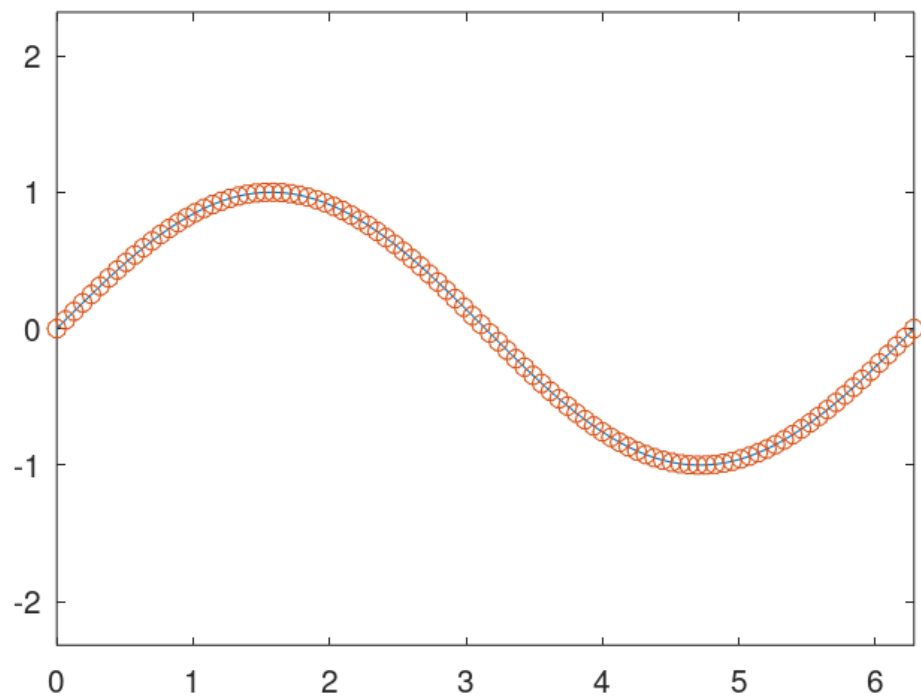
```
t = linspace(0,20,100);
x = sin(t); y = cos(t); z = t;
plot3(x,y,z);
pause;
```

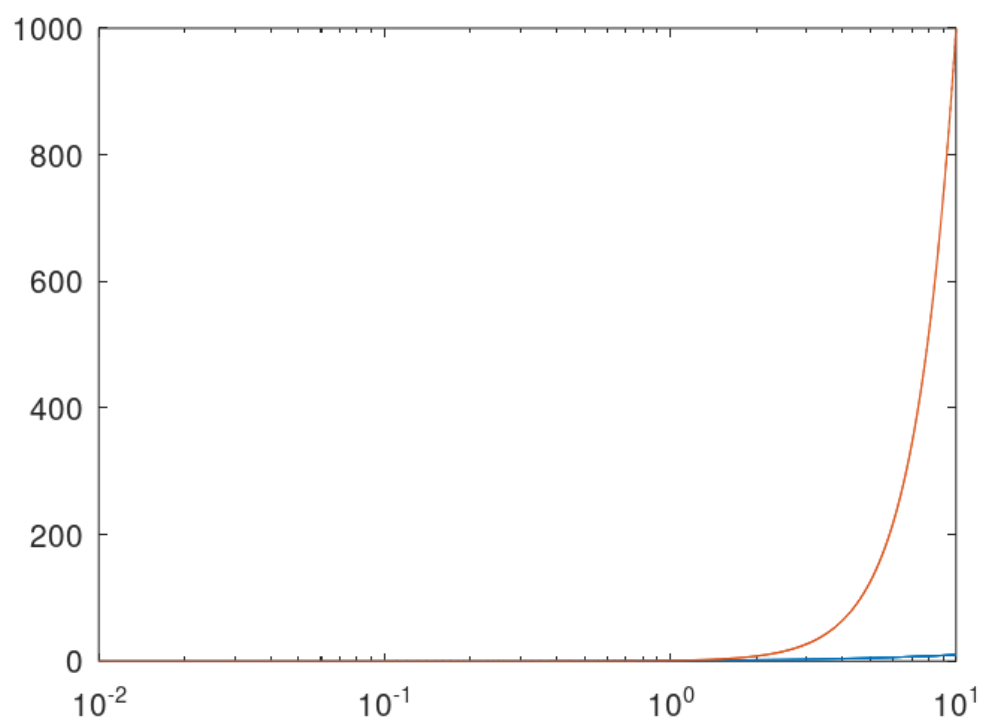
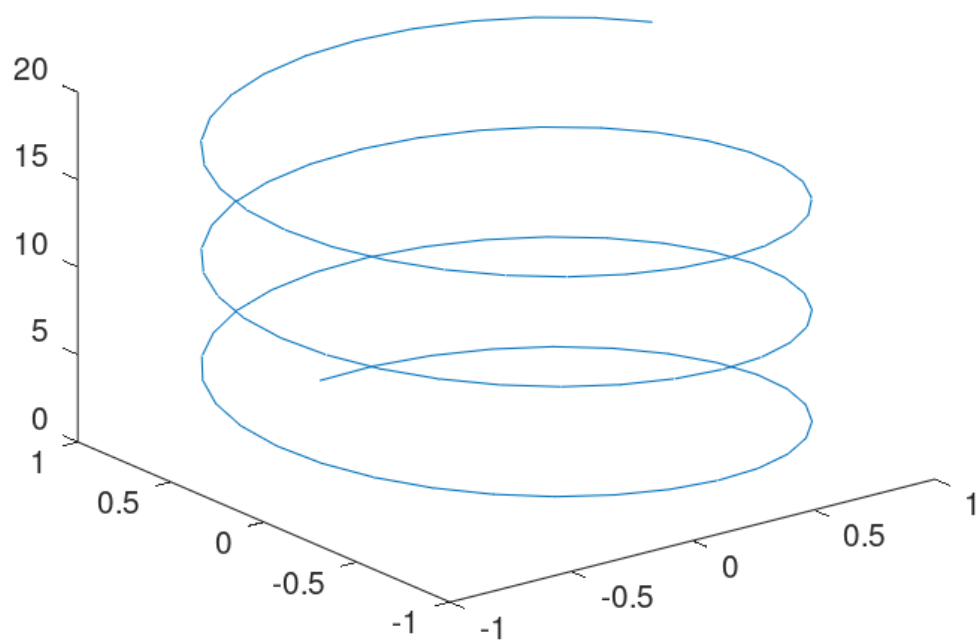
help plot

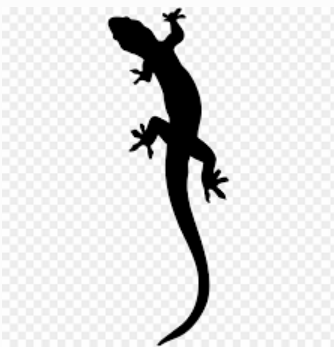
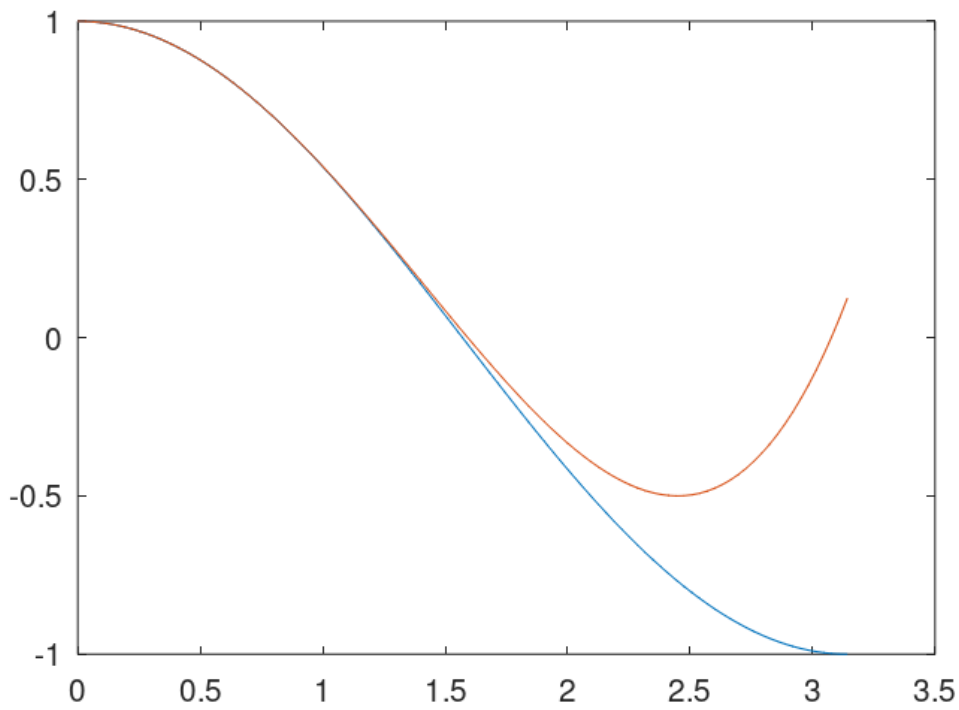
```
x = linspace(0,10,1000);
y = x.^3;
semilogx(x,x,x,y);
pause;
```

```
x = linspace(0,pi,100);  
plot(x,cos(x),x,1-x.^2/2+x.^4/24)  
pause
```

Output







Pg 33 Exercises 2.4 Lesson 4

Commands

```
circle  
who  
whos  
[theta' x' y']  
type circle.m
```

```
lookfor unit
```

```
strfttime ("%r %A %e %B %Y", localtime (time ()))  
disp('____ is the cursed teacher.')
```

Output

Enter the radius of the circle: 9

Variables visible from the current scope:

```
ans      r      theta  x      y
```

Variables visible from the current scope:

variables in scope: top scope

| Attr | Name | Size | Bytes | Class |
|------|-------|-------|-------|--------|
| ==== | ==== | ==== | ==== | ===== |
| | ans | 1x1 | 8 | double |
| | r | 1x1 | 8 | double |
| | theta | 1x100 | 800 | double |
| | x | 1x100 | 800 | double |
| | y | 1x100 | 800 | double |

Total is 302 elements using 2416 bytes

ans =

| | | |
|--------|---------|--------|
| 0 | 9.0000 | 0 |
| 0.0635 | 8.9819 | 0.5708 |
| 0.1269 | 8.9276 | 1.1393 |
| 0.1904 | 8.8374 | 1.7033 |
| 0.2539 | 8.7115 | 2.2603 |
| 0.3173 | 8.5506 | 2.8083 |
| 0.3808 | 8.3553 | 3.3450 |
| 0.4443 | 8.1263 | 3.8682 |
| 0.5077 | 7.8646 | 4.3758 |
| 0.5712 | 7.5713 | 4.8658 |
| 0.6347 | 7.2474 | 5.3362 |
| 0.6981 | 6.8944 | 5.7851 |
| 0.7616 | 6.5136 | 6.2107 |
| 0.8251 | 6.1066 | 6.6113 |
| 0.8885 | 5.6750 | 6.9853 |
| 0.9520 | 5.2205 | 7.3312 |
| 1.0155 | 4.7450 | 7.6475 |
| 1.0789 | 4.2504 | 7.9331 |
| 1.1424 | 3.7387 | 8.1867 |
| 1.2059 | 3.2120 | 8.4073 |
| 1.2693 | 2.6723 | 8.5941 |
| 1.3328 | 2.1218 | 8.7463 |
| 1.3963 | 1.5628 | 8.8633 |
| 1.4597 | 0.9975 | 8.9445 |
| 1.5232 | 0.4282 | 8.9898 |
| 1.5867 | -0.1428 | 8.9989 |
| 1.6501 | -0.7132 | 8.9717 |
| 1.7136 | -1.2808 | 8.9084 |
| 1.7771 | -1.8433 | 8.8092 |

| | | |
|--------|---------|---------|
| 1.8405 | -2.3983 | 8.6746 |
| 1.9040 | -2.9436 | 8.5050 |
| 1.9675 | -3.4771 | 8.3012 |
| 2.0309 | -3.9966 | 8.0639 |
| 2.0944 | -4.5000 | 7.7942 |
| 2.1579 | -4.9853 | 7.4931 |
| 2.2213 | -5.4505 | 7.1619 |
| 2.2848 | -5.8937 | 6.8017 |
| 2.3483 | -6.3133 | 6.4142 |
| 2.4117 | -6.7074 | 6.0009 |
| 2.4752 | -7.0745 | 5.5634 |
| 2.5387 | -7.4131 | 5.1035 |
| 2.6021 | -7.7219 | 4.6231 |
| 2.6656 | -7.9995 | 4.1240 |
| 2.7291 | -8.2450 | 3.6084 |
| 2.7925 | -8.4572 | 3.0782 |
| 2.8560 | -8.6354 | 2.5356 |
| 2.9195 | -8.7789 | 1.9828 |
| 2.9829 | -8.8869 | 1.4220 |
| 3.0464 | -8.9592 | 0.8555 |
| 3.1099 | -8.9955 | 0.2856 |
| 3.1733 | -8.9955 | -0.2856 |
| 3.2368 | -8.9592 | -0.8555 |
| 3.3003 | -8.8869 | -1.4220 |
| 3.3637 | -8.7789 | -1.9828 |
| 3.4272 | -8.6354 | -2.5356 |
| 3.4907 | -8.4572 | -3.0782 |
| 3.5541 | -8.2450 | -3.6084 |
| 3.6176 | -7.9995 | -4.1240 |
| 3.6811 | -7.7219 | -4.6231 |
| 3.7445 | -7.4131 | -5.1035 |
| 3.8080 | -7.0745 | -5.5634 |
| 3.8715 | -6.7074 | -6.0009 |
| 3.9349 | -6.3133 | -6.4142 |
| 3.9984 | -5.8937 | -6.8017 |
| 4.0619 | -5.4505 | -7.1619 |
| 4.1253 | -4.9853 | -7.4931 |
| 4.1888 | -4.5000 | -7.7942 |
| 4.2523 | -3.9966 | -8.0639 |
| 4.3157 | -3.4771 | -8.3012 |
| 4.3792 | -2.9436 | -8.5050 |
| 4.4427 | -2.3983 | -8.6746 |
| 4.5061 | -1.8433 | -8.8092 |
| 4.5696 | -1.2808 | -8.9084 |
| 4.6331 | -0.7132 | -8.9717 |
| 4.6965 | -0.1428 | -8.9989 |
| 4.7600 | 0.4282 | -8.9898 |
| 4.8235 | 0.9975 | -8.9445 |
| 4.8869 | 1.5628 | -8.8633 |
| 4.9504 | 2.1218 | -8.7463 |
| 5.0139 | 2.6723 | -8.5941 |
| 5.0773 | 3.2120 | -8.4073 |
| 5.1408 | 3.7387 | -8.1867 |
| 5.2043 | 4.2504 | -7.9331 |
| 5.2677 | 4.7450 | -7.6475 |
| 5.3312 | 5.2205 | -7.3312 |
| 5.3947 | 5.6750 | -6.9853 |
| 5.4581 | 6.1066 | -6.6113 |
| 5.5216 | 6.5136 | -6.2107 |

| | | |
|--------|--------|---------|
| 5.5851 | 6.8944 | -5.7851 |
| 5.6485 | 7.2474 | -5.3362 |
| 5.7120 | 7.5713 | -4.8658 |
| 5.7755 | 7.8646 | -4.3758 |
| 5.8389 | 8.1263 | -3.8682 |
| 5.9024 | 8.3553 | -3.3450 |
| 5.9659 | 8.5506 | -2.8083 |
| 6.0293 | 8.7115 | -2.2603 |
| 6.0928 | 8.8374 | -1.7033 |
| 6.1563 | 8.9276 | -1.1393 |
| 6.2197 | 8.9819 | -0.5708 |
| 6.2832 | 9.0000 | -0.0000 |

circle.m is the user-defined function defined from: /Users/francischua/gitprojects/octave/circle.m

```
% CIRCLE - A script file to draw a unit circle
% File written by Rudra Pratap. Last modified 6/28/98
% -----
r = input('Enter the radius of the circle: ');
theta = linspace(0,2*pi,100); % create vector theta
x = r * cos(theta);           % generate x-coordinates
y = r * sin(theta);           % generate y-coordinates
plot(x,y);
hold on;
plot(0,0,'x');
axis('equal');
title('Circle of unit radius')
pause
I          Return a scalar, matrix, or N-dimensional array whose elements are all equal to the pure imaginary unit, defined as
sqrt(-1)'.
luupdate   Given an LU factorization of a real or complex matrix A = L
           *U, L lower unit trapezoidal and U upper trapezoidal, return the LU factorization of A + X*Y.
info       Display contact information for the GNU Octave community.
cylinder   Plot a 3-D unit cylinder.
sphere     Plot a 3-D unit sphere.
addtodate   Add Q amount of time (with units F) to the serial datenum, D.
circle     CIRCLE - A script file to draw a unit circle File written by Rudra Pratap.
ans = 05:39:07 PM Thursday 11 March 2021
_____ is the cursed teacher.
```

Bearing

Commands

```
load('assets/bearingdata.mat')
min(data)
bounds(data) # only does lowest
max(data)
mean(data)
median(data)
mode(data)
std(data)
var(data)
```

```
corrcoef(data)
cov(data)
```

Output

```
ans = 2.3601
ans = 2.3601
ans = 2.3650
ans = 2.3623
ans = 2.3623
ans = 2.3601
ans = 1.4878e-03
ans = 2.2135e-06
ans = 1
ans = 2.2135e-06
```

Page 37

Commands

```
help disp
function temp = convert(Ti, Tf)
    C = [Ti: Tf]';
    F = 9/5*C + 32;
    temp = [C F];
end
convert(-1, 10)

function output = fact(n)
    output = 1;
    while n > 1
        output *= n;
        n--;
    endwhile
end

fact(4)
fact(9)

function out = crossprod (u, v)
    out = [u(2)*v(3) - u(3)*v(2), u(3)*v(1) - u(1)*v(3), u(1)*v(2) - u(2)*v(1)];
end

crossprod([1,0,0], [0,1,0])
crossprod([0,1,0], [0,0,1])

function out = summer(r, n)
    out = (r^(n+1)-1)/(r-1);
end

summer(0.5, 5)
summer(1/3, 2)

function out = interest(X, n, r, k)
```

```

    out = X * ((1+r/k)^(k*n)-1);
end

format bank
interest(1000,5,.06, 4)
interest(1000,5,.06, 365)

```

Output

`disp` is a built-in function from the file `libinterp/corefcn/pr-output.cc`

```

-- disp (X)
-- STR = disp (X)
   Display the value of X.

```

For example:

```

disp ("The value of pi is:"), disp (pi)

-| the value of pi is:
-| 3.1416

```

Note that the output from `'disp'` always ends with a newline.

If an output value is requested, `'disp'` prints nothing and returns the formatted output in a string.

See also: `fdisp`.

Additional help for built-in functions and operators is available in the online version of the manual. Use the command `'doc <topic>'` to search the manual index.

Help and information about Octave is also available on the WWW at <https://www.octave.org> and via the help@octave.org mailing list.

```

F =

30.20
32.00
33.80
35.60
37.40
39.20
41.00
42.80
44.60
46.40
48.20
50.00

ans =

-1.00  30.20
  0    32.00
 1.00  33.80
 2.00  35.60
 3.00  37.40

```

```

4.00    39.20
5.00    41.00
6.00    42.80
7.00    44.60
8.00    46.40
9.00    48.20
10.00   50.00

```

```
ans = 24.00
```

```
ans = 362880.00
```

```
ans =
```

```

0      0    1.00

```

```
ans =
```

```

1.00      0      0

```

```
ans = 1.97
```

```
ans = 1.44
```

```
ans = 346.86
```

```
ans = 349.83
```

LAB 6

Textbook Problems

Commands

```

disp('pg 45')
A = [1 2 3; 4 5 6; 7 8 8]
A(2,3)
A(3,3) = 9
B = A(2:3, 1:3)
B = A(2:3, :)
B(:,2)=[]

disp('pg 51')
eye(3)
B = [ones(3) zeros(3,2); zeros(2,3) 4*eye(2)]
diag(B) '
diag(B,1) '
d = [2 4 6 8];
d1 = [-3 -3 -3];
d2 = [-1 -1];
D = diag(d) + diag(d1,1) + diag(d2, -2)

disp('pg 55')
A = [1 2 3; 4 5 6; 7 8 9];
x = A(1,:) '
x'*x
x*x'
A*x
A^2

```

```

A.^2

disp('pg 60')
A = [1 2; 3 4];
asqrt = sqrt(A)
Asqrt = sqrtm(A)
exp_aij = exp(A)
exp_A = expm(A)

disp('pg 68')
A = [5 -3 2; -3 8 4; 4 2 -9];
eig(A)
[eigvec, eigval] = eig(A)

disp('pg 72')
x = 0: .1: 20;
y = exp(0.1*x).*sin(x);
plot(x,y)
xlabel('Time (t) in Seconds')
ylabel('The Response Amplitude in mm')
title('A simple 2-D Plot')
print 'assets/resp_amp.eps' -deps

A = [2 6; 3 9]
B = [1 2; 3 4]
C = [-5 5; 5 3]
(A+B)-(B+A)
((A+B)+C)-(A+(B+C))
(5*(A+B))-(5*A+5*B)
A*(B+C) - (A*B + A*C)
A*B-A*C
A*B-B*A

zeros(2,3)
5*eye(3)
3*ones(2)

G = [A zeros(2,4); zeros(2) B zeros(2); zeros(2,4) C]
G(:,6) = []
G(6,:) = []
G(1:4,1:4)
G(5,5) = 4
G(13) # 1 is the 13 element as a flat vector
G(12,1) = 1 # increases size

A = ones(20);
A(6:15,6:15) = zeros(10);
spy(A) # bunch of stars with empty square in middle
A(16:20,1:5) = zeros(5);
A(1:5,16:20) = zeros(5);
spy(A)

A = diag(1:6) + diag(7:11,1) + diag(12:15,2)
A = A + triu(A,1) '

A = rand(10);
A = fix(A*100)
idx = A < 10;
A(idx) = 0;

```

```

idx = A > 90;
A(idx) = inf
idx = (A <= 50 & A >= 30);
b = A(idx)'
```

Output

pg 45

A =

```

1  2  3
4  5  6
7  8  8
```

ans = 6

A =

```

1  2  3
4  5  6
7  8  9
```

B =

```

4  5  6
7  8  9
```

B =

```

4  5  6
7  8  9
```

B =

```

4  6
7  9
```

pg 51

ans =

Diagonal Matrix

```

1  0  0
0  1  0
0  0  1
```

B =

```

1  1  1  0  0
1  1  1  0  0
1  1  1  0  0
0  0  0  4  0
0  0  0  0  4
```

ans =

```

1  1  1  4  4
```

ans =

1 1 0 0

D =

2 -3 0 0
0 4 -3 0
-1 0 6 -3
0 -1 0 8

pg 55

x =

1
2
3

ans = 14

ans =

1 2 3
2 4 6
3 6 9

ans =

14
32
50

ans =

30 36 42
66 81 96
102 126 150

ans =

1 4 9
16 25 36
49 64 81

pg 60

asqrt =

1.0000 1.4142
1.7321 2.0000

Asqrt =

0.5537 + 0.4644i 0.8070 - 0.2124i
1.2104 - 0.3186i 1.7641 + 0.1458i

exp_aij =

2.7183 7.3891
20.0855 54.5982

exp_A =

| | |
|---------|---------|
| 51.969 | 74.737 |
| 112.105 | 164.074 |

pg 68

ans =

| |
|----------|
| -10.2206 |
| 4.4246 |
| 9.7960 |

eigvec =

| | | |
|-----------|----------|-----------|
| 0.172542 | 0.870606 | -0.537542 |
| 0.238228 | 0.377390 | 0.842875 |
| -0.955760 | 0.315629 | -0.024708 |

eigval =

Diagonal Matrix

| | | |
|----------|--------|--------|
| -10.2206 | 0 | 0 |
| 0 | 4.4246 | 0 |
| 0 | 0 | 9.7960 |

pg 72

A =

| | |
|---|---|
| 2 | 6 |
| 3 | 9 |

B =

| | |
|---|---|
| 1 | 2 |
| 3 | 4 |

C =

| | |
|----|---|
| -5 | 5 |
| 5 | 3 |

ans =

| | |
|---|---|
| 0 | 0 |
| 0 | 0 |

ans =

| | |
|---|---|
| 0 | 0 |
| 0 | 0 |

ans =

| | |
|---|---|
| 0 | 0 |
| 0 | 0 |

ans =

$$\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$$

ans =

$$\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$$

ans =

$$\begin{bmatrix} 12 & 4 \\ 12 & -12 \end{bmatrix}$$

ans =

$$\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

ans =

Diagonal Matrix

$$\begin{bmatrix} 5 & 0 & 0 \\ 0 & 5 & 0 \\ 0 & 0 & 5 \end{bmatrix}$$

ans =

$$\begin{bmatrix} 3 & 3 \\ 3 & 3 \end{bmatrix}$$

G =

$$\begin{bmatrix} 2 & 6 & 0 & 0 & 0 & 0 \\ 3 & 9 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 2 & 0 & 0 \\ 0 & 0 & 3 & 4 & 0 & 0 \\ 0 & 0 & 0 & 0 & -5 & 5 \\ 0 & 0 & 0 & 0 & 5 & 3 \end{bmatrix}$$

G =

$$\begin{bmatrix} 2 & 6 & 0 & 0 & 0 \\ 3 & 9 & 0 & 0 & 0 \\ 0 & 0 & 1 & 2 & 0 \\ 0 & 0 & 3 & 4 & 0 \\ 0 & 0 & 0 & 0 & -5 \\ 0 & 0 & 0 & 0 & 5 \end{bmatrix}$$

G =

$$\begin{bmatrix} 2 & 6 & 0 & 0 & 0 \\ 3 & 9 & 0 & 0 & 0 \\ 0 & 0 & 1 & 2 & 0 \\ 0 & 0 & 3 & 4 & 0 \\ 0 & 0 & 0 & 0 & -5 \end{bmatrix}$$

ans =

| | | | |
|---|---|---|---|
| 2 | 6 | 0 | 0 |
| 3 | 9 | 0 | 0 |
| 0 | 0 | 1 | 2 |
| 0 | 0 | 3 | 4 |

G =

| | | | | |
|---|---|---|---|---|
| 2 | 6 | 0 | 0 | 0 |
| 3 | 9 | 0 | 0 | 0 |
| 0 | 0 | 1 | 2 | 0 |
| 0 | 0 | 3 | 4 | 0 |
| 0 | 0 | 0 | 0 | 4 |

ans = 1

G =

| | | | | |
|---|---|---|---|---|
| 2 | 6 | 0 | 0 | 0 |
| 3 | 9 | 0 | 0 | 0 |
| 0 | 0 | 1 | 2 | 0 |
| 0 | 0 | 3 | 4 | 0 |
| 0 | 0 | 0 | 0 | 4 |
| 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 0 |

A =

| | | | | | |
|---|---|----|----|----|----|
| 1 | 7 | 12 | 0 | 0 | 0 |
| 0 | 2 | 8 | 13 | 0 | 0 |
| 0 | 0 | 3 | 9 | 14 | 0 |
| 0 | 0 | 0 | 4 | 10 | 15 |
| 0 | 0 | 0 | 0 | 5 | 11 |
| 0 | 0 | 0 | 0 | 0 | 6 |

A =

| | | | | | |
|----|----|----|----|----|----|
| 1 | 7 | 12 | 0 | 0 | 0 |
| 7 | 2 | 8 | 13 | 0 | 0 |
| 12 | 8 | 3 | 9 | 14 | 0 |
| 0 | 13 | 9 | 4 | 10 | 15 |
| 0 | 0 | 14 | 10 | 5 | 11 |
| 0 | 0 | 0 | 15 | 11 | 6 |

A =

| | | | | | | | | | |
|----|----|----|----|----|----|----|----|----|----|
| 3 | 1 | 43 | 54 | 38 | 70 | 38 | 56 | 20 | 10 |
| 43 | 9 | 98 | 53 | 42 | 10 | 92 | 67 | 39 | 14 |
| 88 | 75 | 22 | 7 | 31 | 41 | 91 | 21 | 83 | 65 |
| 18 | 56 | 8 | 86 | 54 | 4 | 97 | 7 | 27 | 15 |
| 20 | 23 | 6 | 43 | 81 | 55 | 97 | 65 | 83 | 18 |
| 98 | 93 | 76 | 94 | 44 | 99 | 4 | 26 | 65 | 9 |
| 11 | 78 | 43 | 91 | 23 | 92 | 73 | 49 | 27 | 35 |
| 24 | 78 | 26 | 5 | 83 | 85 | 9 | 16 | 86 | 52 |
| 75 | 13 | 56 | 57 | 84 | 9 | 79 | 48 | 34 | 91 |
| 12 | 38 | 62 | 50 | 11 | 22 | 62 | 39 | 42 | 2 |

A =

| | | | | | | | | | |
|-----|-----|-----|-----|----|-----|-----|----|----|-----|
| 0 | 0 | 43 | 54 | 38 | 70 | 38 | 56 | 20 | 10 |
| 43 | 0 | Inf | 53 | 42 | 10 | Inf | 67 | 39 | 14 |
| 88 | 75 | 22 | 0 | 31 | 41 | Inf | 21 | 83 | 65 |
| 18 | 56 | 0 | 86 | 54 | 0 | Inf | 0 | 27 | 15 |
| 20 | 23 | 0 | 43 | 81 | 55 | Inf | 65 | 83 | 18 |
| Inf | Inf | 76 | Inf | 44 | Inf | 0 | 26 | 65 | 0 |
| 11 | 78 | 43 | Inf | 23 | Inf | 73 | 49 | 27 | 35 |
| 24 | 78 | 26 | 0 | 83 | 85 | 0 | 16 | 86 | 52 |
| 75 | 13 | 56 | 57 | 84 | 0 | 79 | 48 | 34 | Inf |
| 12 | 38 | 62 | 50 | 11 | 22 | 62 | 39 | 42 | 0 |

b =

| | | | | | | | | | | | | | | | | | | |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 43 | 38 | 43 | 43 | 43 | 50 | 38 | 42 | 31 | 44 | 41 | 38 | 49 | 48 | 39 | 39 | 34 | 42 | 35 |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|

LAB 7

Script File

Commands

```
%----- This is the script file 'solvex.m' -----  
% It solves equation (4.1) for x and also calculates det(A).  
  
A = [2 2*r r; 3 6 2*r-1; 2 r-1 3*r];  
b = [2; 3; 5];  
det_A = det(A);  
x = A\b;  
  
%----- CLI Commands -----  
r = 1;  
solvex
```

Output

```
det_A = 10.000  
x =  
  
-0.2000  
0.3000  
1.8000
```

Function File

Commands

```
%----- This is the script file 'solvex.m' -----
function [det_A, x] = solvexf(determinant_func, r);
% SOLVEXF solves a 3x3 watrix equation with parameter function
% To call this function, type:
% [det_A,x] = solvexf(determinant_func, r);
% r is the input and det_A and x are output
% -----
A = [2 2*r r; 3 6 2*r-1; 2 r-1 3*r];
b = [2; 3; 5];
det_A = feval(determinant_func,A)
x = A\b

%----- CLI Commands -----
[detA, x] = solvexf(@det, 1)
```

Output

```
det_A = 10.000
x =

-0.2000
 0.3000
 1.8000
```

Profiling

Commands

```
profile on
[detA, x] = solvexf(@det, 1)
profile off
profshow % shows the contents of the current profiling session
```

Output

```
detA = 10.000
x =

-0.2000
 0.3000
 1.8000
```

| # | Function Attr | Time (s) | Time (%) | Calls |
|----|---------------|----------|----------|-------|
| 9 | profile | 0.000 | 23.76 | 1 |
| 1 | solvexf | 0.000 | 21.38 | 1 |
| 7 | display | 0.000 | 16.70 | 2 |
| 8 | disp | 0.000 | 12.19 | 2 |
| 5 | det | 0.000 | 11.84 | 1 |
| 4 | feval | 0.000 | 6.01 | 1 |
| 6 | binary \ | 0.000 | 4.06 | 1 |
| 12 | false | 0.000 | 1.50 | 1 |
| 2 | binary * | 0.000 | 0.80 | 3 |
| 10 | nargin | 0.000 | 0.71 | 1 |

| | | | | |
|----|---------------------|-------|------|---|
| 11 | binary != | 0.000 | 0.71 | 1 |
| 3 | binary - | 0.000 | 0.35 | 2 |
| 13 | __profiler_enable__ | 0.000 | 0.00 | 1 |

Global Variables

Commands

```
%----- Script File -----
global k_value c_value;

function xdot = ode1(t,x);
% ODE1: function to compute the derivative xdot
global k_value c_value
xdot = k_value * x + c_value * sin(t);
end

k_value = 5; c_value = 2;
ts = [0 20];
x0 = 1.0;
[t, x] = ode23('ode1', ts, x0)
[t(1:10), x(1:10)]
```

Output

```
ans =

      0    1.0000
  0.0178    1.0933
  0.0445    1.2510
  0.0845    1.5337
  0.1330    1.9662
  0.1841    2.5561
  0.2359    3.3370
  0.2881    4.3618
  0.3405    5.7031
  0.3930    7.4565
```

While loops

Commands

```
v = 1; i = 1; num = 0;
while num < 10000
    num = 2^i;
    v = [v; num];
    i = i + 1;
end
v
```

Output

```

v =

    1
    2
    4
    8
   16
   32
   64
  128
  256
  512
 1024
 2048
 4096
 8192
16384

```

Switch, if, keyboard

Commands

```

%----- This is the script file 'work.m' -----
A = ones(10)
for i = 1:10
    disp(i)
    if i == 5
        keyboard
    elseif i==4
        for j=1:10
            switch mod(A(3,j),2)
                case 0
                    A(4,j) = 1;
                case 1
                    A (4,j) = -2;
            end
        end
    end
    A(:,i) = i*A(:,i);
end
%----- CLI Commands -----
work
keyboard> A
keyboard> return
A

```

Output

```

octave:45>work
A =

    1    1    1    1    1    1    1    1    1    1
    1    1    1    1    1    1    1    1    1    1
    1    1    1    1    1    1    1    1    1    1
    1    1    1    1    1    1    1    1    1    1

```

```

1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1

1
2
3
4
5
stopped in solvexf at line 5 [~/octave/solvexf.m]
5: keyboard
keyboard> A
A =

```

```

1 2 3 4 1 1 1 1 1 1
1 2 3 4 1 1 1 1 1 1
1 2 3 4 1 1 1 1 1 1
-2 1 -2 -8 -2 -2 -2 -2 -2 -2
1 2 3 4 1 1 1 1 1 1
1 2 3 4 1 1 1 1 1 1
1 2 3 4 1 1 1 1 1 1
1 2 3 4 1 1 1 1 1 1
1 2 3 4 1 1 1 1 1 1
1 2 3 4 1 1 1 1 1 1

```

```
keyboard> return
```

```

6
7
8
9
10
octave:46> A
A =

```

```

1 2 3 4 5 6 7 8 9 10
1 2 3 4 5 6 7 8 9 10
1 2 3 4 5 6 7 8 9 10
-2 1 -2 -8 -10 -12 -14 -16 -18 -20
1 2 3 4 5 6 7 8 9 10
1 2 3 4 5 6 7 8 9 10
1 2 3 4 5 6 7 8 9 10
1 2 3 4 5 6 7 8 9 10
1 2 3 4 5 6 7 8 9 10
1 2 3 4 5 6 7 8 9 10

```

Demonstration Script

Commands

```

function [det_A, x] = solvexf(determinant_func);
% SOLVEXF solves a 3x3 watrix equation with parameter function
r = input('r: ');
A = [5 2*r r; 3 6 2*r-1; 2 r-1 3*r]
b = [2;3;5];

```



```

det_A = feval(determinant_func,det(A)) % uses a user defined function to compute determinant
x = A\b;
gain_control = input('Would you like to gain control? (y/n) ','s');
switch gain_control
    case 'y'
        disp('Type "return" and hit RETURN to continue. ');
        keyboard;
    case 'n'
        choice = menu('What would you like to do now?','Sleep','print ''x''');
        switch choice
            case 1
                disp('Goodnight')
                exit
            case 2
                x
                disp('.')
                pause(1)
                disp('.')
                pause(1)
                disp('.')
                pause(1)
                disp('GO SLEEP')
                exit
            end
        otherwise
            error('Invalid Choice');
    end
disp('Continuing')
FallSem(1).course = 'cs101';
FallSem(1).prof = 'turing';
FallSem(1).score = [80 75 95];
FallSem
FallSem(2).course = 'phy200';
FallSem(2).prof = 'Fiegenbaum';
FallSem(2).score = [72 75 78];
FallSem
FallSem(2).course
container = cell(2,2);
container{1,1} = FallSem(1);
container{2,1} = FallSem(2);
container{1,2} = 2;
container{2,2} = 'a';
container
end

solvexf('det');

```

Output

Started execution

r: 1

A =

```

5  2  1
3  6  1
2  0  3

```

det_A = 64

```

Would you like to gain control? (y/n) y
Type "return" and hit RETURN to continue.
stopped in solvexf at line 14 [/Users/francischua/gitprojects/octave/work.m]
14:         keyboard;
keyboard> r
r = 1
keyboard> return
Continuing
FallSem =

    scalar structure containing the fields:

    course = cs101
    prof = turing
    score =

        80    75    95

FallSem =

    1x2 struct array containing the fields:

    course
    prof
    score

ans = phy200
container =
{
    [1,1] =

        scalar structure containing the fields:

        course = cs101
        prof = turing
        score =

            80    75    95

    [2,1] =

        scalar structure containing the fields:

        course = phy200
        prof = Fiegenbaum
        score =

            72    75    78

    [1,2] = 2
    [2,2] = a
}

```

LAB 8

Linear Regression

Commands

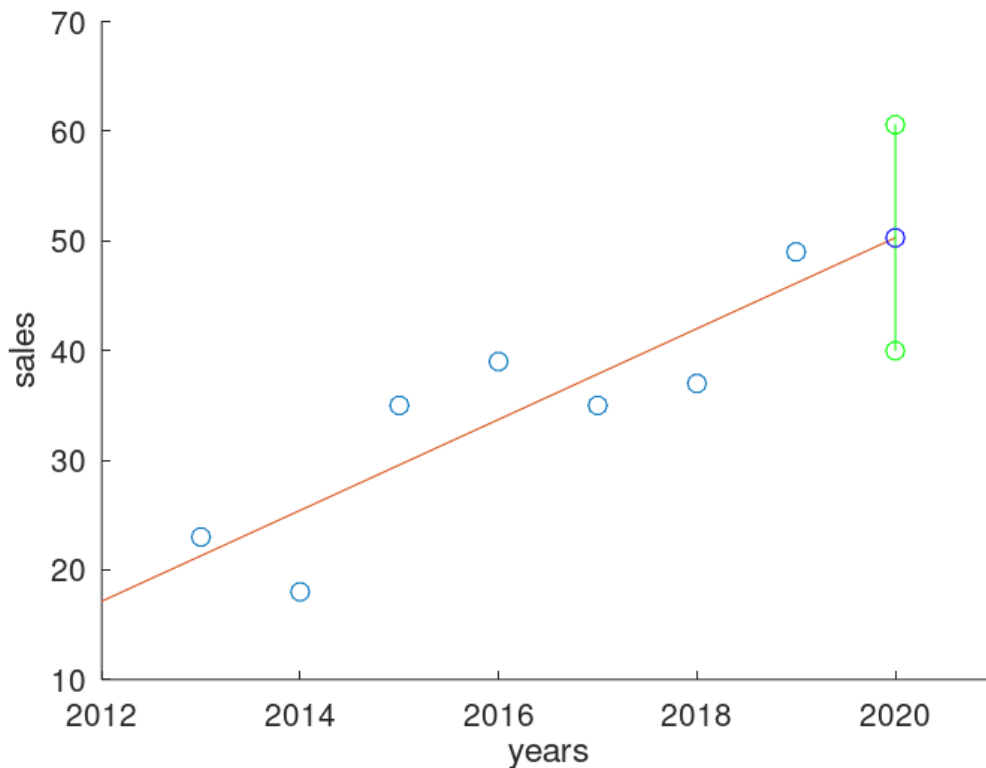
```
type forecasting_data.txt;
data = load("-ascii", "forecasting_data.txt");
n = size(data)(1)
AVG = mean(data)
SUM_SQUARE = var(data(:,1))*(n-1)
COV_N = sum((data(:,1) - AVG(1)) .* (data(:,2) - AVG(2)))
b = COV_N / SUM_SQUARE
a = AVG(2) - b * AVG(1)
epsilon = std(data(:,2))
% epsilon = sqrt(sum((data(:,2) - AVG(2)).^2)/(n-1)). This gives a different number from shown.
disp('68% confidence. r not calculated')
Y_low = a + b*2020 - epsilon
Y_high = a + b*2020 + epsilon
hold on
scatter(data(:,1),data(:,2),'o')
plot([2012 2020],[2012*b + a, 2020*b + a])
plot([2020 2020], [Y_low, Y_high], 'go-')
plot([2020], [a + b*2020], 'bo')
hold off
xlabel('years')
xlabel('sales')
axis([2012,2021,10,70])
pause
```

Output

```
2013    23
2014    18
2015    35
2016    39
2017    35
2018    37
2019    49
n = 7
AVG =

    2016.000    33.714

SUM_SQUARE = 28
COV_N = 116
b = 4.1429
a = -8318.3
epsilon = 10.307
68% confidence. r not calcaulted
Y_low = 39.979
Y_high = 60.593
```



LAB 10

Data Manipulation

Commands

```
# load data from bearingdata.mat
load('assets/bearingdata.mat')
# show the first few values of the data
data(1:5)
# perform transformation
data_grams = data * 28.35;
# show last few values of transformed data
data_grams(96:100)
# save the new data to a file
save('assets/bearing_data_grams','data_grams')
# show the median of new data
median(data_grams)
# find the smallest and largest elements of the new data
[smallest,largest] = bounds(data_grams)
# show the use of format long
format long
ounce = 0.0283495;
data_kilograms = data * ounce;
data_kilograms(96:100)
```

Output

ans =

```
2.364942089643925
2.362699910495190
2.363534587096614
2.364997458100488
2.361439246724076
```

ans =

```
66.99682176558042
66.95260941494178
66.99867785420295
67.01218938489492
66.98866657743373
```

ans = 66.97214821453088

smallest = 66.90746521565018

largest = 67.04767793714885

ans =

```
6.699564016378561e-02
6.695142859290623e-02
6.699749621967289e-02
6.701100751206626e-02
6.698748511946939e-02
```

Script Files

Commands

```
# show and execute velocity.m
type velocity.m
velocity
# show and execute mars_velocity.m
type mars_velocity.m
mars_velocity
# show and execute rating_to_pound.m
type rating_to_pound.m
rating_to_pound
```

Output

velocity.m is the user-defined function defined from: /Users/francischua/gitprojects/octave/velocity

```
# --- VELOCITY.M FILE --- #
dia = 2.5;
gravity = 981
%A = cross-sectional area or pi*((d/2)^2) Note: d/2 gives radius
area = pi*((dia/2)^2);
%m = mass of the falling object
mass = 65.4710;
%p = density (air = 1.225 kg/m^3) or .001225 g/cm^3
airDensity = 0.001225;
```

```

%C = drag coefficient for sphere is 0.47
C=0.47
% Vt = sqrt(2mg)/(pCA)
Vt = sqrt((2*mass*gravity)/(airDensity*C*area))
# --- VELOCITY.M FILE --- #
gravity = 981
C = 0.4700000000000000
Vt = 6741.741030699041
mars_velocity.m is the user-defined function defined from: /Users/francischua/gitprojects/octave/mars_velocity.m

# --- MARS_VELOCITY.M FILE --- #
dia = .025;
gravity = 3.711;
area = pi*((dia/2)^2);
mass=65.4710;
airDensity = 20.;
C=0.47;
Vt=sqrt((2*mass*gravity)/(airDensity*C*area))
# --- MARS_VELOCITY.M FILE --- #
Vt = 324.5159789486731
rating_to_pound.m is the user-defined function defined from: /Users/francischua/gitprojects/octave/rating_to_pound.m

# --- RATING_TO_POUND.M --- #
lbf=224.809;
open = 6;
closed = 20;
openlbf = open * lbf;
closed =closed * lbf
# --- RATING_TO_POUND.M --- #
closed = 4496.180000000000

```

Miscellaneous Commands

Commands

```

# show int8 bounds (2^7 = 128)
x = int8(120) + int8(50)
# usage of fix
x = fix(3.4) + rem(5,2)
# usage of ceil
x = ceil(3.4) + rem(5,2)
# manipulate character array
st = '12345';
st(1)=72; st(2)=69; st(3)=76; st(4)=76; st(5)=79
# show string comparison
text1 = 'Four score';
text2 = '87 years ago';
text3 = 'Four score';
strcmp(text1, text2)
strcmp(text1, text3)
# strfind
text1 = 'Four score and seven years ago';
index = strfind(text1, 'seven')
# failing to add different integer types
% sum2=int16(5) + int8(3)
# load the io package and then the xlsx
pkg load io

```

```

A = xlsread('assets/ChromeExport2.xlsx');
A(1:5,:)
# logical operators
x = 1;
y = 5;
z = ~(x<y)||~(y <x) && islogical(x)
# typecast to unsigned int
x = 55 + uint32(-22) + pi
x = int8(ceil(rem(-528.6,200)))
# random integers, shows a 3d matrix
A = randi(15,4,5,2)

```

Output

```

x = 127
x = 4
x = 5
st = HELLO
ans = 0
ans = 1
index = 16
ans =

    22    16050075    NaN    NaN    NaN    100
    22    16050115    NaN    NaN    NaN    100
    22    16050213    NaN    NaN    NaN    100
    22    16050319    NaN    NaN    NaN    100
    22    16050527    NaN    NaN    NaN    100

z = 0
x = 58
x = -128
A =

ans(:, :, 1) =

     2     8     2    12     6
     3    14    12    14    12
    13    15    15    15    12
     8    10     7     7    12

ans(:, :, 2) =

     8     3     2    15     5
     6    11     9    13     5
    13     1     6    13     8
    10     1    11    15    15

```

Classes

Commands

```

aScalar = int16(345);
string1 = 'To be or not to be';
aVector = int8(1:5);
aArray = [3,3];

```

```
class(aScalar)
class(string1)
class(aVector)
class(aArray)
```

Output

```
ans = int16
ans = char
ans = int8
ans = double
```

Sizes

Commands

```
aScalar = int16(345);
string1 = 'To be or not to be';
aVector = int8(1:3);
aArray1 = randi(2,3);
aArray2 = [2,3];

size(aScalar)
size(string1)
size(aVector)
size(aArray1)
size(aArray2)
```

Output

```
ans =

     1     1

ans =

     1    18

ans =

     1     3

ans =

     3     3

ans =

     1     2
```

Sparse Cell

Commands

```
b = cell(4,5);  
b{1,1} = 'Good Morning';  
b{1,2} = 'Bonjour';  
b{3,4} = cos(45);  
b{4,1} = int16(432);  
b
```

Output

```
b =  
{  
    [1,1] = Good Morning  
    [2,1] = [] (0x0)  
    [3,1] = [] (0x0)  
    [4,1] = 432  
    [1,2] = Bonjour  
    [2,2] = [] (0x0)  
    [3,2] = [] (0x0)  
    [4,2] = [] (0x0)  
    [1,3] = [] (0x0)  
    [2,3] = [] (0x0)  
    [3,3] = [] (0x0)  
    [4,3] = [] (0x0)  
    [1,4] = [] (0x0)  
    [2,4] = [] (0x0)  
    [3,4] = 0.525321988817730  
    [4,4] = [] (0x0)  
    [1,5] = [] (0x0)  
    [2,5] = [] (0x0)  
    [3,5] = [] (0x0)  
    [4,5] = [] (0x0)  
}
```

Arbitrary Fields

Commands

```
rocket.manufacturer = 'SpaceX'
```

Output

```
rocket =  
  
    scalar structure containing the fields:  
  
    manufacturer = SpaceX
```

Extract Every Other

Commands

```
A1 = randi(8,8)
A2 = A1(2:2:8,2:2:8)
```

Output

A1 =

```
5 5 6 4 8 6 4 2
4 2 7 8 4 6 6 3
8 7 5 1 6 3 5 1
5 4 4 5 4 5 1 8
1 5 6 4 4 3 8 7
8 6 4 2 7 2 1 4
5 8 5 4 8 6 6 6
5 6 2 1 8 3 7 2
```

A2 =

```
2 8 6 3
4 5 5 8
6 2 2 4
6 1 3 2
```

Matrix Generating

Commands

```
randi(2,3)
randi(2,2,3)
magic(3)
A = magic(4)
for i = 1:4
    row = sum(A(i,:))
endfor
for i = 1:4
    col = sum(A(:,i))
endfor
diagonal = A(1,1) + A(2,2) + A(3,3) + A(4,4)
diagonal = A(1,4) + A(2,3) + A(3,2) + A(4,1)
```

Output

ans =

```
2 1 1
1 1 1
2 2 1
```

ans =

```
2 1 1
2 1 2
```

ans =

```
8  1  6
3  5  7
4  9  2
```

A =

```
16   2   3  13
 5  11  10   8
 9   7   6  12
 4  14  15   1
```

```
row = 34
row = 34
row = 34
row = 34
col = 34
col = 34
col = 34
col = 34
diagonal = 34
diagonal = 34
```

Tables

Commands

Octave does not currently support Tables.

Output

LAB 11

Loops

Commands

```
x = 0;
while x<6
    x = x + 1;
    fprintf('x = %d\n',x);
endwhile
for x = 1:10
    if x == 6
        break;
    endif
    disp(x);
endfor
```

Output

```
x = 1
x = 2
x = 3
x = 4
x = 5
x = 6
1
2
3
4
5
```

Conditionals

Commands

```
octave_version = 6; os = 'mac';
if x < 3
    disp('Get an ugrade')
else
    switch os
        case 'mac'
            disp('brew install octave')
        case 'windows'
            printf('Why do astronauts use Linux?\nBecause they can''t open Windows in space.\n');
        case 'linux'
            disp('"'People assume that time is a strict progression of cause to effect but, actually, fr
    end
endif
```

Output

```
brew install octave
```

Image

Commands

```
imageFile = './assets/pretty.png';
ImageMap = imread(imageFile);
rows = size(ImageMap,1);
columns = size(ImageMap,2);
if (rows > 0 && columns > 0)
    y = 1;
    while y <= rows
        for x = 1:columns
            for i = 1:3
                ImageMap(y, x, i) = 255 - ImageMap(y, x, i); end
            end
            y = y + 1;
        end
        imwrite(ImageMap, imageFile);
    end
```



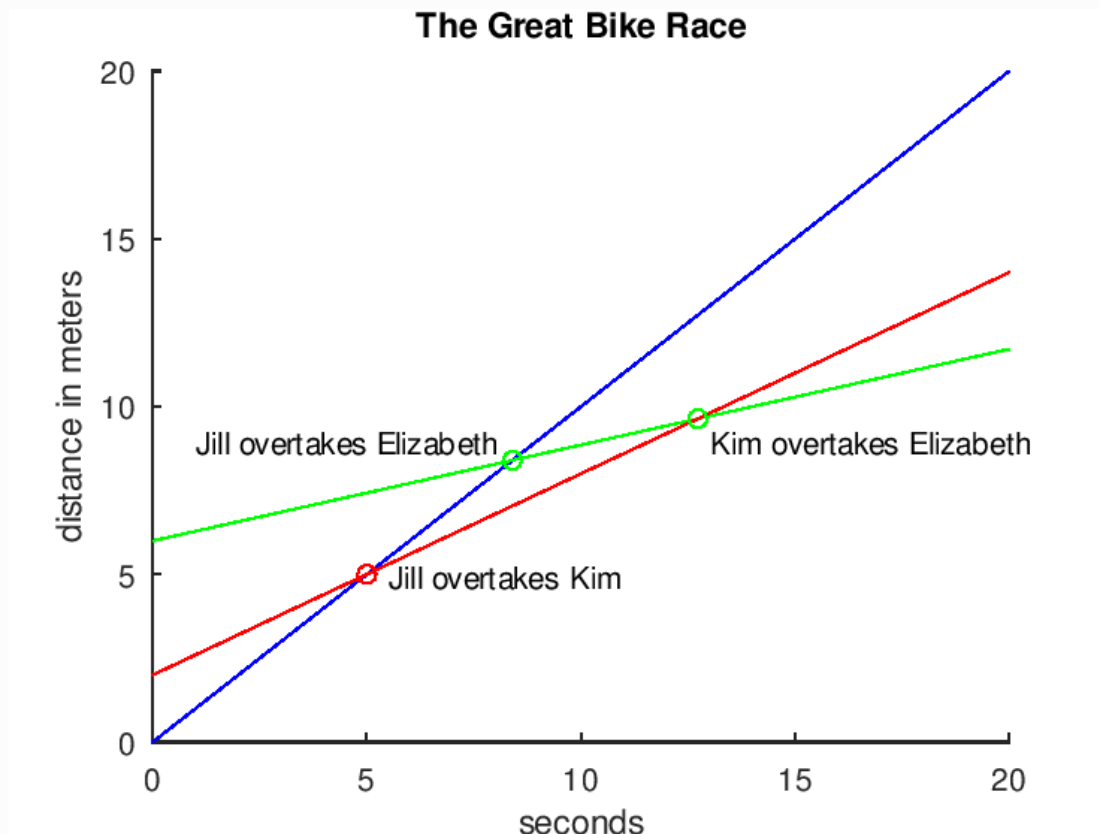

LAB 12

The Great Bike Race

Commands

```
x = 0:20;  
y = 2/7*x +6;  
z = 3/5 * x + 2;  
hold on;  
plot(x,x,'b',x,y,'g',x,z,'r')  
plot(42/5,42/5, 'go');  
plot((6-2)/(3/5-2/7),(6-2)/(3/5-2/7)*2/7+6, 'go');  
plot(5,5, 'ro');  
hold off;  
text (0,0,"Jill overtakes Elizabeth", "position", [4 9 0]);  
text (0,0,"Kim overtakes Elizabeth", "position", [13 9 0]);  
text (0,0,"Jill overtakes Kim", "position", [5.5 5 0]);  
title ('The Great Bike Race');  
xlabel('seconds'); ylabel('distance in meters');
```

Output



Simultaneous Arrival Plot

Commands

```

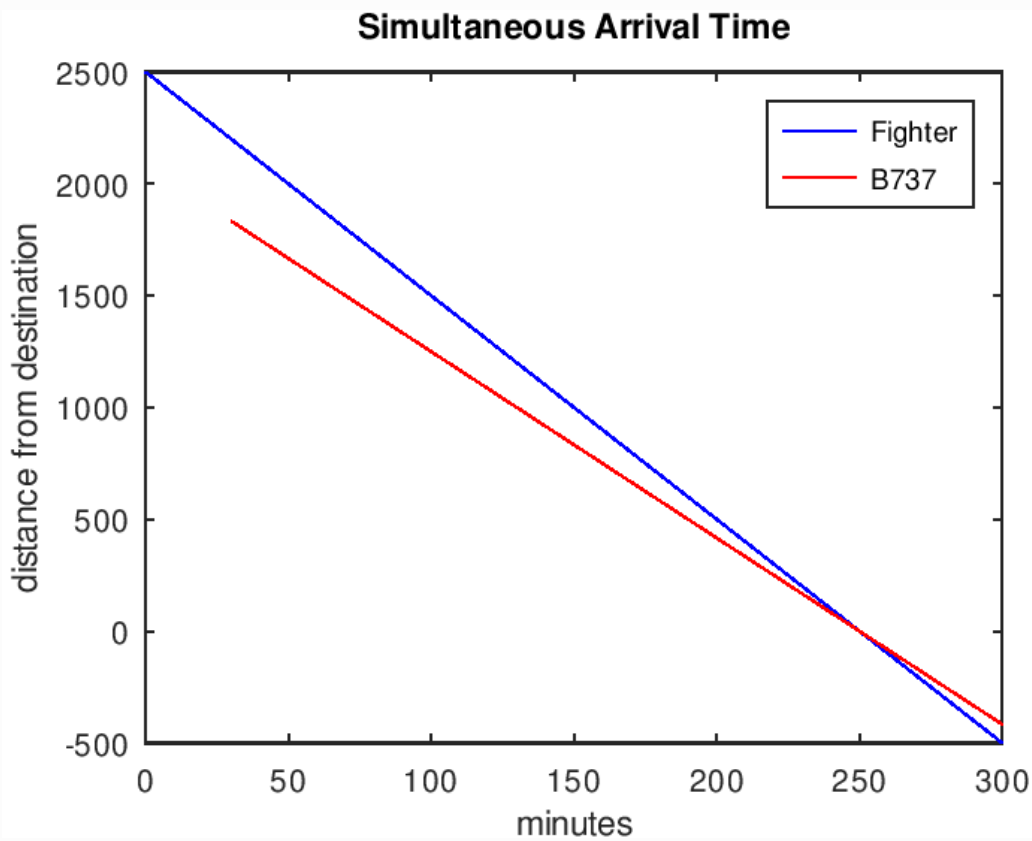
x_fighter = 0:10:300;
x_b7 = 30:10:300;
m_fighter = -600/60;
b_fighter = 2500;
minutes_taken_fighter = b_fighter / (-m_fighter);
minutes_taken_b7 = minutes_taken_fighter - 30;
m_b7 = -500/60;
b_b7 = - minutes_taken_b7 * m_b7;

y_fighter = x_fighter * m_fighter + b_fighter;
y_b7 = (x_b7 - 30) * m_b7 + b_b7;

plot(x_fighter,y_fighter,'b',x_b7,y_b7,'r')
title ('Simultaneous Arrival Time');
xlabel('minutes'); ylabel('distance from destination');
legend ("Fighter", "B737");

```

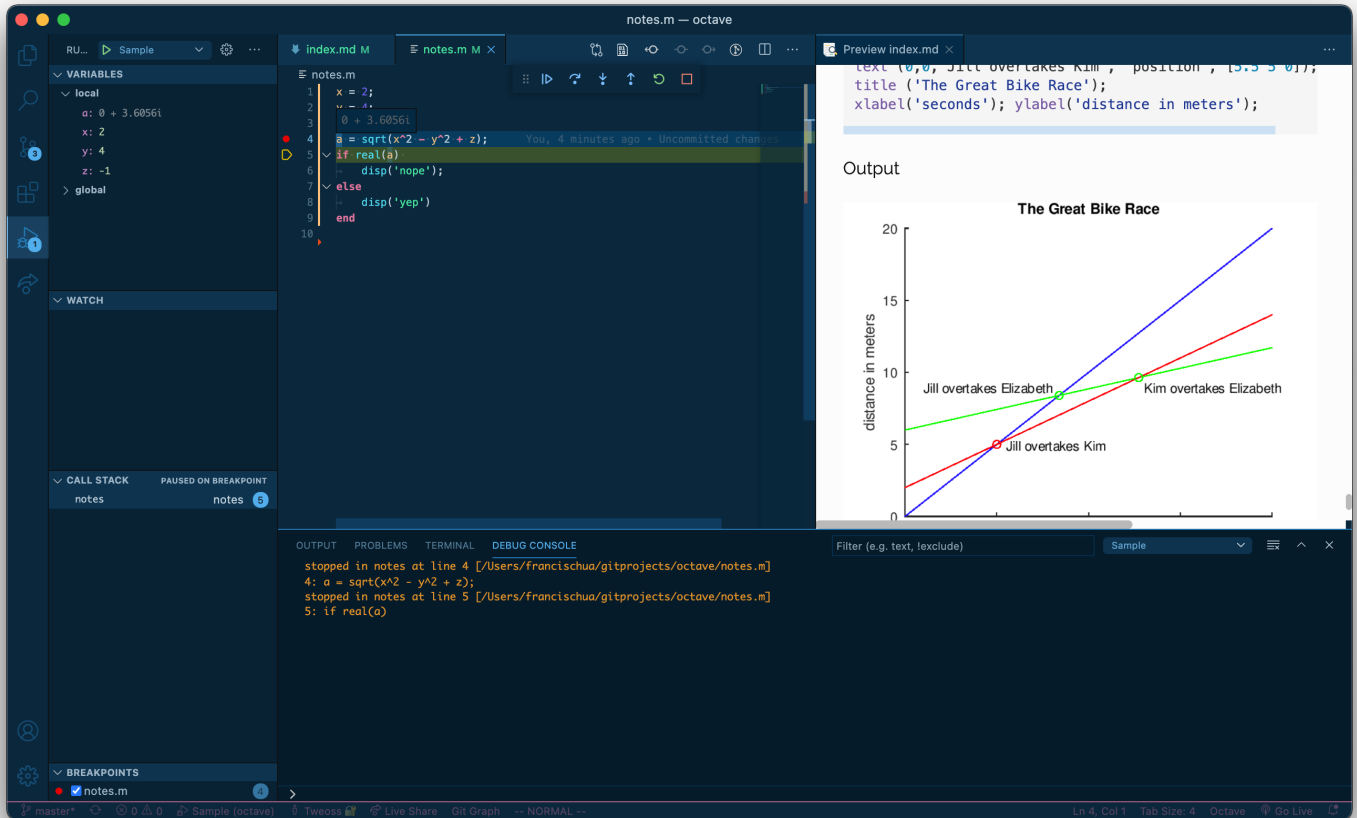
Output



LAB EXTRA

Extra examples to demonstrate proficiency of skills in the check sheet.

Debugging



File System

Commands

```
x = 1;  
ls  
mkdir temp_example  
cd temp_example  
save var_file x  
type var_file  
ls  
cd ..  
ls
```

Output

```
MatlabNotesPadded.pdf    index.md    notes.m    quizzes    velo  
assets                   index.pdf  notes.pdf  rating_to_pound.m  
index.html               mars_velocity.m  octave-workspace  regex.txt  
# Created by Octave 6.1.0, Mon May 03 22:41:06 2021 PDT <francischua@Francis-MBP.local>  
# name: x  
# type: scalar  
1  
  
var_file
```

| | | | | |
|-----------------------|-----------------|------------------|-------------------|-------|
| MatlabNotesPadded.pdf | index.md | notes.m | quizzes | temp. |
| assets | index.pdf | notes.pdf | rating_to_pound.m | velo |
| index.html | mars_velocity.m | octave-workspace | regex.txt | |

Geometric Sum

Commands

```

output_precision (10)
r = input('Ratio = ');
first_element = input('First Element = ');
approximation = 0;
for i = 0:10
    approximation += r^i * first_element;
endfor
approximation

exact = first_element / (1 - r)

```

Output

```

Ratio = 0.523
First Element = 6
approximation = 12.56854352
exact = 12.578616350

```

Bacteria Outbreak

Commands

```

x = 0:0.1:5;
title ('Bacteria Growth');
xlabel('Time (hours)'); ylabel('Bacteria Population, P(t)');
hold on;
for a = 1:0.1:2
    plot(x, 1000/a*exp(.5*a*x))
end
legend ("1.0", "1.1", "1.2", "1.3", "1.4", "1.5", "1.6", "1.7", "1.8", "1.9", "2.0", "location", "we:
hold off;

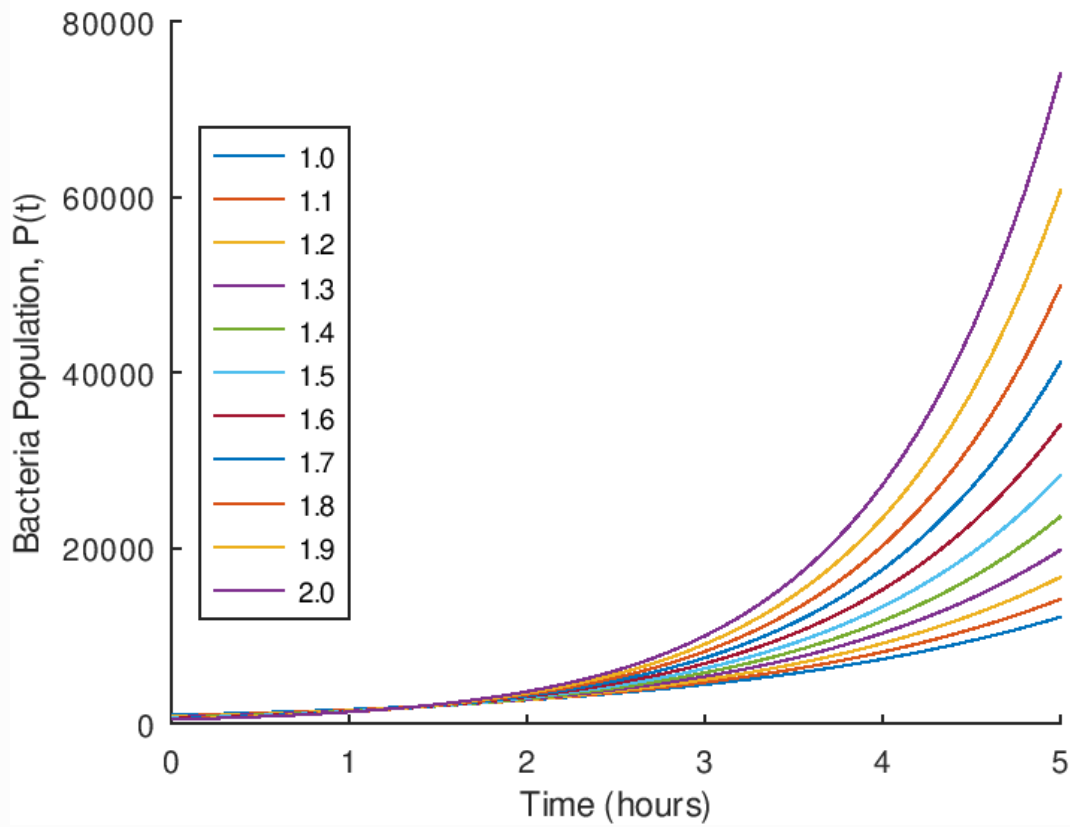
pause

clf
title ('Bacteria Growth');
xlabel('Time (hours)'); ylabel('Bacteria Population, P(t)');
hold on;
for a = 1:0.1:2
    semilogy(x, 1000/a*exp(.5*a*x))
end
legend ("1.0", "1.1", "1.2", "1.3", "1.4", "1.5", "1.6", "1.7", "1.8", "1.9", "2.0", "location", "we:
hold off;

```

Output

Bacteria Growth



Bacteria Growth

